Performance Modification of Saudi-Asphalt Binders Using SABIC Polymers

H. I. Al-Abdul Wahhab, I. M. Asi, and M. G. Baig

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Abstract: Asphalt binder is a thermoplastic liquid, which behaves as an elastic solid at low service temperatures or during rapid loading. At high temperature or slow loading, it behaves as a viscous liquid. This classical dichotomy creates a need to improve the performance of an asphalt binder to minimize the stress cracking that occurs at low temperatures and the plastic deformation at high temperatures. Use of polymer-modified asphalt binder is one of the solutions to meet the required performance standards for the pavements of today. It appears to be a logical, practical, and economical approach.

In the Kingdom of Saudi Arabia, most of the used asphalt-polymers are imported from abroad, which led to increase the total construction cost. The main objective of this research is to modify locally produced asphalt using polymer produced by Saudi Basic Industries Company (SABIC). The study covered the asphalt binders produced by Riyadh refinery. Ten polymers were identified as potential asphalt modifiers based on their physical properties and chemical composition. Based on the preliminary laboratory evaluation for the melting point of these polymers, five polymers were selected for local asphalt modification. In the initial stage, required mixing time was decided based on the relation between shear loss modulus and mixing time. The optimum polymer content was selected based on Superpave binder performance grade specifications. The suitability of improvement was verified through the evaluation of permanent deformation and fatigue behavior of laboratory prepared asphalt concrete mixes. The results indicate that the rheological properties of the modified binders were improved significantly with sufficient polymer content (3%). They were also influenced by the type and content of the polymer. The aging properties of the modified binders were found to be dependent on the type of polymer. The fatigue life and resistance to permanent deformation were significantly improved due to the improvement in the rheological properties of the binders. In general, the research has demonstrated the potentiality of modifying local asphalts using SABIC polymers.

Key Words: Polymer, Rheology, Modified asphalt mixtures, Fatigue, Rutting, Permanent deformation.